**Name: Period: Seat#:**

**Worksheet #1**

1. For each system below, indicate whether ΔS and ΔH is a positive or negative value. Then indicate if the reaction is entropy driven, enthalpy driven, both or neither. Qualitative, you do not need to do calculations for this part.

|  |  |  |
| --- | --- | --- |
| 1. NaCl (s) + H2O (*l*) + heat → NaCl (aq)
 | 1. O2 (g) + H2O (l) → O2 (aq) + heat
 | 1. CO2 (s) + heat → CO2 (g)
 |
| ΔS = | ΔS = | ΔS = |
| ΔH = | ΔH = | ΔH = |
| Driven? | Driven? | Driven? |

1. Quantitative, do calculations for this part. Calculate the ΔH°rxn, ΔS°rxn, ΔG°rxn, Then, indicate whether ΔH°, ΔS°, ΔG° are positive or negative values. Then indicate if the reaction is spontaneous or not. Then indicate if the reaction is entropy driven, enthalpy driven, both, or neither. Then calculate ΔSuniverse to further show if the reaction is spontaneous or not, remember the entropy of the universe should be increasing for spontaneous reactions!
*\*Hint\** must solve for temperature first before you can find ∆Suniv!

|  |  |  |  |
| --- | --- | --- | --- |
| **Substance** | **ΔH˚formation (kJ/mole)** | **ΔS˚formation (J/mole˚K)** | **ΔG˚formation (kJ/mole)** |
| C3H8 (*l*) | -103.8 | 269.9 | -23.5 |
| O2 (g) | 0 | 205.1 | 0 |
| CO2 (g) | -393.5 | 213.7 | -394.4 |
| H2O (g) | -241.8 | 188.8 | -228.6 |
| TiO2 (s) | -939.7 | 49.9 | -884.5 |
| TiCl4 (*l*) | -804.2 | 252.3 | -737.2 |
| C (s) | 0 | 5.7 | 0 |
| Cl2 (g) | 0 | 223.1 | 0 |
| $$∆H°= Σ∆H\_{f}^{°} prod.-Σ∆H\_{f}^{°} react.$$ | $$∆S°= Σ∆S^{°} prod.-Σ∆S^{°} react.$$ | $$∆G^{°}=∆H^{°}-T∆S^{°}$$ | $$∆S\_{universe}= \frac{-∆H}{T}$$ |
| 1. C3H8 (*l*) + 5 O2 (g) → 3CO2 (g) + 4H2O (g)

*After calculations circle/highlight:**ΔH°* + or -*ΔS°* + or -*ΔG°* + or -*Spontaneous /”thermodynamically favorable”:*  Yes No*Driven:*  Enthalpy Entropy Both Neither*ΔSuniv* + or -*6840 J/molK* |
| 1. TiO2 (s) + C (s) + 2Cl2 (g) → TiCl4 (*l*) + CO2­ (g)

*After calculations circle/highlight:**ΔH°* + or -*ΔS°* + or -*ΔG°* + or -*Spontaneous /”thermodynamically favorable”:*  Yes No*Driven:*  Enthalpy Entropy Both Neither*ΔSuniv* + or *847 J/molK* |